NEW YORK STATE NUTRIENT STANDARDS PLAN

REVISED AND UPDATED APRIL 15, 2009

INTRODUCTION AND OVERVIEW

This document updates the 2-1-08 NYS Nutrient Standards Plan. This document describes New York's existing strong approach to addressing nutrient over-enrichment, along with the plan to refine it in response to the U.S. Environmental Protection Agency (USEPA)'s requirements that states adopt nutrient criteria for lakes and reservoirs, and for rivers and streams. When the USEPA publishes nutrient criteria for other waterbody types (estuaries and coastal marine waters and their wetlands) applicable to New York, New York will work with USEPA to determine the most appropriate nutrient criteria for these waters.

It is essential to note that meeting the time frames in this Plan is contingent upon DEC staff availability, based on DEC staffing levels, other priorities, and requests from the EPA. Completing certain elements of the Plan is also contingent upon sufficient federal funding to complete the work in a timely manner.

The USEPA has derived and published recommended criteria for the several ecoregions included within New York. The "Level III" ecoregions within New York are 58, 59, 60, 61, 62, 67, 83, and 84 (see table and map in Appendix 1). The aggregate ecoregions are VII, VIII, XI, and XIV. The USEPA recommends that states establish criteria for both nutrients [nitrogen (N), and phosphorus (P) and response variables (chlorophyll a and/or water clarity)].

State adoption of the USEPA's criteria recommendations as standards is one option to meeting USEPA's requirements. Derivation and adoption of state-specific standards for nutrients is another option. Because New York does not believe that the USEPA criteria are necessarily appropriate for New York's waters, New York intends to derive its own, state-specific criteria for nutrients for both ponded and flowing waters, as detailed below. New York believes that these criteria, based on data from New York State, will more accurately represent nutrient levels necessary to protect the designated uses (best uses) of New York's waters.

This plan details New York's ongoing work toward derivation of nutrient criteria for lakes, reservoirs, rivers, and streams, and some potential future work on estuaries. The various research projects, and the criteria that they support [or are expected to support] are in various stages of progress. To balance the need to establish criteria as soon as possible, with the extensive administrative action needed to establish them, New York expects to move forward with two separate administrative actions. First, to establish as guidance values the nutrient criteria being derived for: 1) aquatic life in wadeable rivers and streams, 2) human health in ponded waters, and 3) recreational use in ponded waters. Fact Sheets that support these draft guidance values were prepared in early 2008 and will continue to undergo internal review in early calendar year (CY) 2009. These fact sheets will also be provided to USEPA for review by June 30, 2009. Guidance

values, in the Division of Water's TOGS 1.1.1, represent numerical translations of New York's existing narrative standards, and have been widely used and accepted by USEPA Region II for more than 20 years. It is anticipated that guidance values for the above uses and waters will be proposed no later than March 31, 2010. New York may subsequently propose these as standards in a future rule making.

For non-wadeable rivers and streams, additional research regarding the impact of nutrients on aquatic life has been completed. A fact sheet will be prepared, reviewed internally, and provided to USEPA for review by September 30, 2009. It is anticipated that guidance values will be proposed no later than March 31, 2010. New York may subsequently propose these as standards in a future rule making.

Research now being conducted regarding the impact of nutrients on human health in flowing waters, will be completed by September 30, 2009. However, any criteria that this work may support will not be ready for the 2009 guidance values proposal. Additional research is necessary to assess the impacts of nutrients on recreation in flowing waters, and on aquatic life in ponded waters. This work may take several years, and criteria that it may support would not be proposed before 2012 (tentative) at the earliest. Criteria from this work, and from the work on human health in flowing waters, would be proposed in a single administrative action, to establish guidance values. New York may subsequently propose these as standards in a future rule making.

NEW YORK STATE'S EXISTING PROGRAM TO ADDRESS NUTRIENTS

New York has a strong existing program to address water quality impacts from nutrient over-enrichment, including narrative standards, a numerical guidance value, and other, waterbody-specific numerical values. The plan described in this document builds upon New York's existing strength, by adding numerical values for nutrients for rivers and streams, and for lakes and reservoirs.

Narrative Standards

New York has existing narrative ambient water quality standards for phosphorus and nitrogen, promulgated in regulation at 6 NYCRR 703.2. This standard sets forth limits for these two nutrients as "None in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages."

Guidance Value

New York has an existing ambient water quality guidance value of 20 ug/L for phosphorus, established for Classes A, AA, A-S, AA-S, and B waters for which the letter "P" (ponds, lakes, and reservoirs) appears in the Water Index Number, excluding Lake Champlain. New York's guidance values are a long-established practice of translation of its narrative standards, and are authorized in state regulation at 6 NYCRR 702.15. Guidance Values, including this one for phosphorus, are compiled in Division of Water Technical and Operational Guidance Series (TOGS) No. 1.1.1.

Waterbody-Specific Values for Phosphorus

- Lakes Erie and Ontario: The Lake Erie target TP concentration is divided up by basin, with the Western Basin equal to 15 µg/L and the Central and Eastern basins equal 10 µg/L. Lake Ontario's target is 10 µg/L. These target P numbers for Erie and Ontario are in supporting documents to the GLWQA. Detailed information is online at http://www.epa.gov/glnpo/solec/94/nutrient/index.html#EXECUTIVE

- Lake Champlain (NY side): Main Lake - 10 µg/L, South Lake - 25-54 µg/L, remainder of lake - 14 µg/L. These values are from the VT-NY Agreement and were also used in the phosphorus TMDL.

- New York City Watershed reservoirs: 15 µg/L for terminal reservoirs. This value (plus the statewide guidance value of 20 µg/L) was used in the reservoir phosphorus TMDLs.

- Waters of the Forest Preserve: Natural conditions.

NEW YORK'S PLAN TO REVISE AND EXPAND ITS NUTRIENT CRITERIA PROGRAM

There are four basic elements of NY's approach:

1.a. Human Health - Lakes and Reservoirs
1.b. Human Health - Flowing Waters

2.a. Recreation - Lakes and Reservoirs
2.b. Recreation - Flowing Waters

3.a. Aquatic Life - Lakes and Reservoirs
3.b. Aquatic Life - Wadeable Flowing Waters
3.c. Aquatic Life - Non-Wadeable Flowing Waters

New York's approach is summarized in the table below.

Targeted Uses to be protected	Applicable Water body Type	Additional research to be completed	Proposal as part of the First administrative action by 3-31-2010 *	Proposal as part of the Second administrative action in 2012**
Human Health (water source)	Lakes/Reservoirs	none	X	
Human Health (water source)	Flowing	Sept. 30, 2009*		X
Recreation	Lakes/Reservoirs	none	X	
Recreation	Flowing	2011*		X
Aquatic Life	Lakes/Reservoirs	2011*		X
Aquatic Life	Flowing (wadeable)	none	X	
Aquatic Life	Flowing (non-wadeable)	done	X	

* Contingent upon DEC staff availability, in consideration of DEC staffing levels, other priorities, and requests from the EPA.

** Contingent upon sufficient federal funding to complete the work in a timely manner, as well as DEC staff availability, in consideration of other priorities and requests from the EPA.

Details of each of these four elements are provided below.

1. CRITERIA TO PROTECT HUMAN HEALTH AND SOURCES OF POTABLE WATER SUPPLY

a. Lakes and Reservoirs;
(Classes A, A-S, AA, AA-S) (Cliff Callinan)

Summary

For lakes and reservoirs classified as sources of potable water supply (the A classes), research is ongoing to evaluate the relation between nutrients (and related response variables) and the production of disinfection byproducts (DBPs) and algal toxins, and to derive nutrient criteria for ponded Class "AA" and "A" waters. These criteria will be extended to ponded waters of Classes A-S and AA-S. Additional research is being conducted to determine equivalent criteria for flowing water systems of Classes A, AA, A-S, and AA-S. Because nearly all freshwater systems in NYS are phosphorus-limited rather than nitrogen-limited, the nitrogen criteria would only kick in when it can be demonstrated that a waterbody is nitrogen limited. This would lead us to retain a narrative standard rather than develop a numeric value(s) for nitrogen under most circumstances. New York will consider whether it would be appropriate to also establish some form of numeric criteria for a nitrogen-limited system.

Introduction

In 1998, USEPA announced a National Strategy for the Development of Regional Nutrient Criteria (CFR, 1998). This Strategy describes the approach that the USEPA will take for development of scientific information relating to nutrients [i.e., water quality criteria pursuant to Section 304(a) of the Clean Water Act] and to working with States to assure adoption of nutrient criteria into State water quality standards pursuant to Section 303(c) of the Clean Water Act. To assist states in their efforts to establish nutrient criteria, the USEPA is providing funding to support work directed at development of scientifically defensible nutrient criteria. This Project was developed in response to a USEPA request for applications concerning this National Strategy.

NYSDEC and NYSDOH are collectively charged with safeguarding the quality of potable water supplies within the State of New York. Toward that end these agencies are involved in monitoring activities with the overarching goal of assessing and safeguarding designated uses. Nutrients, and related parameters, can play an important role in determining the quality of potable water supplies. Nutrients, and associated response variables, are known to play a role in two human health concerns related to drinking water: (a) formation of disinfection by-products (DBPs), and (b) the production of algal toxics.

Public health officials have become increasingly concerned with the formation of DBPs in public water supplies over the past decade. DBPs (e.g., Chloroform and related compounds) are a class of organic chemicals formed as the result of the disinfection process. These compounds are believed to be carcinogenic. DBPs are formed from a chemical reaction between chlorine and Natural Organic

Matter (NOM). In general, the higher the levels of organic matter within the source water, the greater the potential for the formation of DBPs. The NOM present in a lake and/or reservoir can originate from either the surrounding watershed (termed allochthonous production) or can be generated within the waterbody itself (termed autochthonous production). This latter process can be controlled by a number of factors (e.g., nutrient levels, light, etc.). However, for freshwater lakes within North America, the controlling factor for autochthonous production is most often the nutrient phosphorus. Thus, a primary determinant in the production of DBPs for surface water supplies is the level of nutrients and primary productivity within the receiving water. It follows, therefore, that the levels of phosphorus and resultant levels of algae will have direct bearing on the nutrient criteria development process as it relates to waters with a designated best use of potable water supply.

Algal toxins are another group of compounds that pose a potential risk to potable water supplies. These compounds are produced under certain circumstances by a group of autotrophic bacteria classified as cyanobacteria – also known as blue-green algae. These toxins are capable of causing harm to humans and other animals. Under certain conditions these organisms can increase significantly in numbers resulting in what is termed an algal bloom. These bloom events are more likely to occur under elevated nutrient conditions. Thus, one important element in the management of cyanobacteria and related toxin production can be limiting nutrient levels to the source water.

Purpose

The Project is designed to evaluate the relationship between nutrients (and related response variables) and the production of DBPs and algal toxins, for the purpose of developing nutrient criteria for Class "AA" and "A" waters in New York State.

Ongoing Work

The basic experimental design consists of collection of paired measurements of nutrient related indices (total phosphorus and chlorophyll a) and human health related indices (disinfection by-product formation potentials and algal toxins). These paired measurements will be used to assess the relationship between nutrient related parameters and human health related indices. The correlative relationships will then be compared to applicable ambient water quality standards and/or drinking water standards to determine appropriate nutrient related standards for the protection of human health.

The Project consists of the following tasks: (a) collection of water column samples from a number of Class "AA" and "A" lakes and reservoirs within New York State, (b) analysis of water samples for nutrient related parameters (total phosphorus, chlorophyll a, water clarity), disinfection by-product formation potential, and algal toxins, (c) selected analysis of water samples for phytoplankton identification and enumeration, (d) compilation of water purveyor system information regarding DBP levels in water supply distribution systems, and (e) analysis of all data to determine appropriately protective nutrient criteria.

The field component of the Project was conducted from May through October of 2004, however, supplemental field investigations were conducted during 2007 as part of a follow-on study - see below. Project activities included the collection of ambient water samples from approximately 20 lakes and/or reservoirs. Targeted waters were selected to encompass a relatively broad range of trophic conditions and represent a number of the Level III Ecoregions found in New York State and surrounding region.

The Project will include development of a technical report detailing the findings and conclusions of the study, and will be complete by September 30, 2009. An interim Project Summary dated August 20, 2007 is available. The Quality Assurance Project Plan (QAPP) for the Project has been approved by the USEPA Region II.

Nutrient Criteria Products

The project takes an effects-based approach to establishing nutrient criteria. Criteria will be developed for total phosphorus (TP) and chlorophyll a. A criterion will also be developed for water clarity, of a type to be determined based on the results of the study. The criteria will be based on relationships between nutrient indices (chlorophyll a and TP) and related human health indices (DBPFP and algal toxins), with the goal of establishing threshold levels of the former to prevent exceedances of the latter in drinking water supplies. These relationships are to be defined by the study. Criteria based on the results of this study will be proposed as guidance values as outlined in the "Introduction and Overview"section of this plan. Although the study was conducted on Class AA and A waters, the criteria derived are expected to be appropriate for all ponded surface waters classified as sources of potable water supply. Thus, any criteria derived will also be adopted for Class AA- Special and A-Special waters.

The extension of study results to moving waters (rivers and streams) is questionable given the differences between ponded and moving water systems. In brief, the concern is as follows - in ponded systems the nutrients present have a significantly better opportunity to "build-out" organic matter by prompting algal growth, whereas, in moving systems the "build-out" of organic matter at a particular point in the system is more limited as the nutrient moves past the point. Thus, the ultimate nutrient criteria for ponded systems would likely be more restrictive than for moving systems, although this would also need to consider downstream concerns as well (e.g., ponded water supply source).

In 2007, USEPA provided New York and New Jersey with funding to initiate a Paleolimnology Project designed to: (a) define and refine nutrient-related reference conditions, (b) define reasonable target nutrient concentrations with respect to restoration efforts, (c) verify ecoregional delineations, (d) evaluate water quality trends, and (e) assess dissolved oxygen dynamics within regional lakes. The project will involve development and/or extension of inferential models for the purpose of estimating historical water quality conditions with respect to trophic indices (primarily phosphorus) and dissolved oxygen. Inferential models to assess historical trophic conditions will be based on sedimentary diatoms, while estimates of historical dissolved oxygen

conditions will be based on sedimentary remains of Chironomids. The project also builds upon previous paleolimnology studies conducted as part of the USEPA Environmental Monitoring and Assessment Program (EMAP).

The initial phase of the project is proceeding well, however, additional funding will be necessary to fully realize the goals of this project. Subsequent work would involve a continuation of on-going work with the already established team of researchers, and this effort would substantially bolster New York's efforts on all ponded water criteria (potable waters, recreation, and aquatic life), as well as contributing to efforts to move forward with revisions of freshwater dissolved oxygen criteria and listing methodology.

b. Flowing Waters

In 2007, USEPA provided follow-on funding to extend efforts regarding nutrient criteria as they relate to potable waters. The follow-on project is designed to answer several remaining issues related to nutrient criteria for potable waters, as follows.

The most important issue remaining is to determine how these relationships play out with respect to *flowing water systems*. It is likely that nutrient thresholds will be somewhat higher for flowing waters due to the fact that there is less opportunity for resident algae to fully utilize available nutrients in these systems, and therefore there is likely to be lower primary productivity per unit of nutrient than in ponded systems. This new investigation (or next phase of the overall effort) will follow a similar experimental design as for the earlier effort, and will collect monthly samples on approximately 15 flowing water systems throughout New York State. To date, the QAPP for the project has been completed and sample collection has been underway since May 2007. Additional work to be completed by September 30, 2009, includes completion of sample collection and analysis, as well as data analysis and report development.

In addition to the *flowing water portion* of the follow-on investigation, additional work will be conducted on *ponded systems* in an effort to sure up certain unanswered questions on this category of waters. Additional work will include: (a) sample collection on two additional ponded water sources to confirm applicability of existing relationships; (b) follow-up sampling will be conducted on two of the original systems to evaluate inter-annual variability for given parameters; (c) addition parameters of true color and SUVA (specific UV absorbance) will be evaluated to assess the import of humic materials in the generation of THMs and to evaluate the value of surrogate measures, respectively; (d) coupled samples will be collected from several lakes/reservoirs and their primary tributary to further investigate the nature of DBP precursor source categories (allochthonous verses autochthonous); (e) spatial variability (both horizontal and vertical) within given systems will be assessed using synoptic longitudinal events and episodic discrete depth sampling events, respectively; and (f) investigation of probable removal capability of conventional water treatment processes for THMFP and algal toxins using paired raw water and finished water samples.

Two individual reports will be issued at the conclusion of the follow-on investigation that will detail results from both efforts, one for ponded waters and one for flowing waters. Given the additional work underway, and due to its likely bearing on the final results, it is thought preferable to defer completion of the reports until the conclusion of the follow-on project (scheduled for September 30, 2009).

2. CRITERIA TO PROTECT PRIMARY CONTACT RECREATION

(Scott Kishbaugh)

a) Lakes and Reservoirs:

Summary

For primary contact recreation for lakes and reservoirs, the perception data compiled by the Division of Water's Citizens Statewide Lake Assessment Program will be used to identify levels of phosphorus (as well as the response variables, water clarity and chlorophyll a) that correspond to unimpacted, impacted, and impaired uses. These criteria will be applied to Class B waters and likely to the A classes as well. NYSDEC will consider the extent to which these same criteria will be applied to Class C waters, or if separate criteria are more appropriate. Because nearly all freshwater systems in NYS are phosphorus-limited rather than nitrogen-limited, the nitrogen criteria would only kick in when it can be demonstrated that a waterbody is nitrogen limited. This would lead us to retain a narrative standard rather than develop a numeric value(s) for nitrogen under most circumstances. New York will consider whether it would be appropriate to also establish some form of numeric criteria for a nitrogen-limited system.

Background

New York has recognized that existing approaches for establishing nutrient criteria, such as narrative standards, present guidance values, or the default 304(a) criteria, do not address the primary consequences of over-enrichment of surface waters- human use impairment- that has driven much of the need for developing nutrient criteria. While water quality standard development has traditionally focused on protection of human health or aquatic life, the most sensitive uses impaired by eutrophication are often related to the aesthetic quality of the water, such as primary contact recreation. In recognition of the limitation of these approaches to protect the aesthetic quality of the water and the best use of recreation from nutrient over-enrichment, the USEPA strongly encourages the use of alternative or supplemental methods for assigning nutrient criteria through identification of reference conditions or reference waterbodies. The NYSDEC completed a two year study for USEPA Regions I, II, and V involving the use of use impairment data linked with water quality data to identify reference conditions as part of the nutrient criteria development process. Data were evaluated from eight states and three USEPA regions, all collected in a similar manner using standardized lake perception surveys, spread over eight aggregate USEPA ecoregions, twenty-six level III USEPA ecoregions, and 200,000 samples. Data were evaluated using a variety of methodologies to identify reference conditions, mostly

consistent with historical methodologies used to identify intrastate ecoregions and the USEPA CALM methodology used to identify support of designated uses. Reference conditions are defined as the 75th percentile of the reference dataset, consistent with the USEPA recommendations.

One proposed methodology defines reference waterbodies as those that are "slightly impaired" at a frequency of <10%, consistent with the CALM methodology (as adapted by several states) for "fully supporting" designated uses and historical precedent for utilizing use impairment data in identifying state guidance values. Reference conditions are calculated from the use impairment dataset using these definitions for reference waterbodies. Another methodology defines reference as corresponding to sampling conditions described as "could not be nicer" or (having) "very minor aesthetic problems,"while another method applies USEPA guidance encouraging the use of the "most protective....approach for reference condition calculations", using USEPA guidelines to identify "adequate" datasets. A "composite" methodology assigns the percentage of lakes meeting the criteria in previous methodologies to the entire USEPA nutrient dataset. A summary of the methodologies and the resulting reference condition calculations is available in the final report for this study provided to USEPA Regions I, II, and V.

Nutrient Criteria Products

New York intends to use these findings to identify supplemental calculations of reference conditions to be considered with the default 304(a) criteria to determine final nutrient criteria for waterbodies used for primary contact recreation (primarily Class B and C). These criteria will initially be established for Class B waters. When the criteria to protect this use are derived, NYSDEC will consider the extent to which these same criteria should be applied to Class C waters. Because primary contact recreation is also a best use for Class A, A-S, AA, and AA-S waters, it is likely that these criteria will also apply to these waters. However, nutrient criteria for drinking water source protection are likely to be more stringent and will be the controlling criteria for these waters.

Once the NYSDEC establishes guidelines for defining reference conditions and/or reference waterbodies, these guidelines will be applied to the methods presented in this study to derive supplemental reference condition calculations. It is expected that this will strengthen the final nutrient criteria adopted by New York by providing a more diverse approach that considers a composite of a frequency distribution/statistically based approach (the default 304(a) criteria), a threshold based approach (the existing narrative standard and guidance value) and a use-impairment based approach (the lake perception/use impairment study calculations).

As to resources and timing, we have sufficient information in hand to start answering these questions, and adequate resources in hand to do this. While some additional data collection (on-going) will help to fill in some of the datagaps in some of the level III ecoregions (and the smaller aggregate ecoregions), and we don't yet have enough total nitrogen data to address numeric criteria for any of the ecoregions, the database should be large enough in most of the level III and aggregate ecoregions to begin answering these questions for TP, chlorophyll, and water clarity.

The key decision about where we draw the line between unimpacted, impacted, and impaired waters is being addressed, and draft criteria will be developed starting in the winter of 2008.

Discussion of which criteria are appropriate for which water classes, will be undertaken in conjunction with and following this derivation process.

Extension/continuation of the Paleolimnology Project (see above) would also be beneficial to the future refinement of recreation criteria for ponded systems and the development of aquatic life criteria for ponded systems.

b) Flowing Waters:

Survey work was conducted during the 2008 field season, utilizing field perception surveys comparable to those used in the ponded waters assessments. As with the ponded water systems, survey results will be paired with stressor (phosphorus and nitrogen) and response variables (chlorophyll a, Secchi disk transparency, and turbidity) to evaluate correlations between these variables and perception responses. Definitions of acceptable impacts (the determination about where to "draw the line") adopted in the ponded water nutrient criteria development process will inform the process for identifying acceptable impacts in flowing waters. It is anticipated that the process for developing draft criteria for flowing waters will be lagged behind the criteria process for ponded waters for at least two years, to allow for sufficient data collection across ranges of large river systems and ecoregions to determine if these gradients need to be built into the draft criteria.

It is essential to emphasize that adherence to the above schedule is contingent upon sufficient federal funding to complete the work in a timely manner, as well as DEC staff availability, in consideration of other priorities and requests from the EPA.

3. CRITERIA TO PROTECT AQUATIC LIFE

a. Lakes and Reservoirs (A.J. Smith)

Summary

Research is to be conducted which will evaluate the integrity of aquatic life in lakes and reservoirs in relation to eutrophication from phosphorus and nitrogen. Biological communities were sampled in a subset of lakes from across NYS in 2008 as part of the NYS ambient water quality monitoring program (lakes and reservoirs). As data is collected nutrient criteria will be inferred based on the relationships between nutrient concentrations and biological community integrity. This is to be an ongoing project and sufficient data for drawing conclusions regarding nutrient criteria is not expected until after several years of sampling and data analysis has been conducted.

It is essential to emphasize that adherence to the above schedule is contingent upon sufficient federal funding to complete the work in a timely manner, as well as DEC staff availability, in consideration of other priorities and requests from the EPA.

Extension/continuation of the Paleolimnology Project (see above) would also be beneficial to the future refinement of recreation criteria for ponded systems and the development of aquatic life criteria for ponded systems.

b. Wadeable Streams: Nutrients and the Biotic Community (A.J. Smith)

Summary

For wadeable rivers and streams, levels of nutrient concentrations for both nitrogen and phosphorus above which the aquatic invertebrate communities become degraded have been established as a result of research conducted throughout NYS. This work is summarized in Smith et al. (2007). Based on the study results, NYS can now derive an ambient nutrient standard or guidance value in terms of levels of nitrogen and phosphorus that would not cause impairment of the biotic community as measured by macroinvertebrates. In addition, this study developed a biotic index of nutrient enrichment for macroinvertebrates in New York State which is now used in the detection and prediction of water quality impact resulting from non-point source nutrient inputs. It also allows New York State to associate ranges of nutrient concentration with changes in biotic communities. Therefore it is possible to identify levels of nutrients which cause perturbation and establish nutrient impairment criteria for wadeable streams.

From ongoing studies, NYSDEC will continue to refine nutrient criteria for wadeable streams through continued sampling of biological communities and water chemistries throughout the state. A project funded by the EPA began in 2008 to incorporate nutrient criteria response variables missing from the dataset in Smith et al. (2007). These additional response variables include periphyton community analysis, Chlorophyll-a, and aesthetic value observations. This new data is meant to act as supplemental information in refining the guidance values for phosphorus and nitrogen which are expected to be proposed by 3-31-2010.

c. Non-Wadeable Streams and Rivers: Historical Data on Nutrients and Water Quality and RIBS Sampling Pilot Study (A.J. Smith and Margaret Novak)

Summary

For non-wadeable rivers and streams, the Division of Water's historical record of statewide monitoring is being used to supplement and complement ongoing research targeted at addressing aquatic life use impairment from nutrients in large rivers of NYS. This work has been completed.

Details of Research and Products

The objective of this project is to develop effects-based aquatic life numeric nutrient criteria for non-wadeable rivers and streams in New York State. The strategy of the project will be three-fold: 1) to develop background nutrient conditions for large rivers in the different aggregate ecoregions, 2) to determine effects of varying nutrient concentrations on algal and invertebrate communities, and 3) to develop numeric nutrient criteria based on the information gathered in research strategy items 1 and 2 immediately above. A review of the historical biological and water chemistry data collected during and after 1993 in large, non-wadeable rivers throughout New York State will be conducted. USGS National Water Quality Assessment program data will also be utilized during this phase. Biological water quality assessments will be used to identify reference conditions and corresponding nutrient concentrations which do not cause impairment to aquatic life use. Additional nutrient criteria response variable data was collected over the summer seasons of 2006 and 2007 to supplement the historical data and provide information on additional response variables. This data set includes macroinvertebrate and periphyton community data, algal biomass as chlorophyll a, turbidity, secchi depth, and a full suite of nutrient and basic chemical parameters as well as basic habitat measurements. Based on the behavior of response variables to increasing levels of eutrophication, namely invertebrate and periphyton community data, and algal biomass as chlorophyll a, nutrient criteria will be derived. Criteria will likely be derived within a three-tiered framework similar to that planned for NYS wadeable streams and rivers. This framework consists of a reference, acceptable, and unacceptable range of nutrients for the different nutrient ecoregions. The current project will fully support the goal of developing regional numeric nutrient criteria for both nitrogen and phosphorus that will be protective and scientifically defensible.

Reference:

Smith, A. J., R. W. Bode, and G. S. Kleppel. 2007. A nutrient biotic index (NBI) for use with benthic macroinvertebrate communities. Ecological Indicators 7:371-386

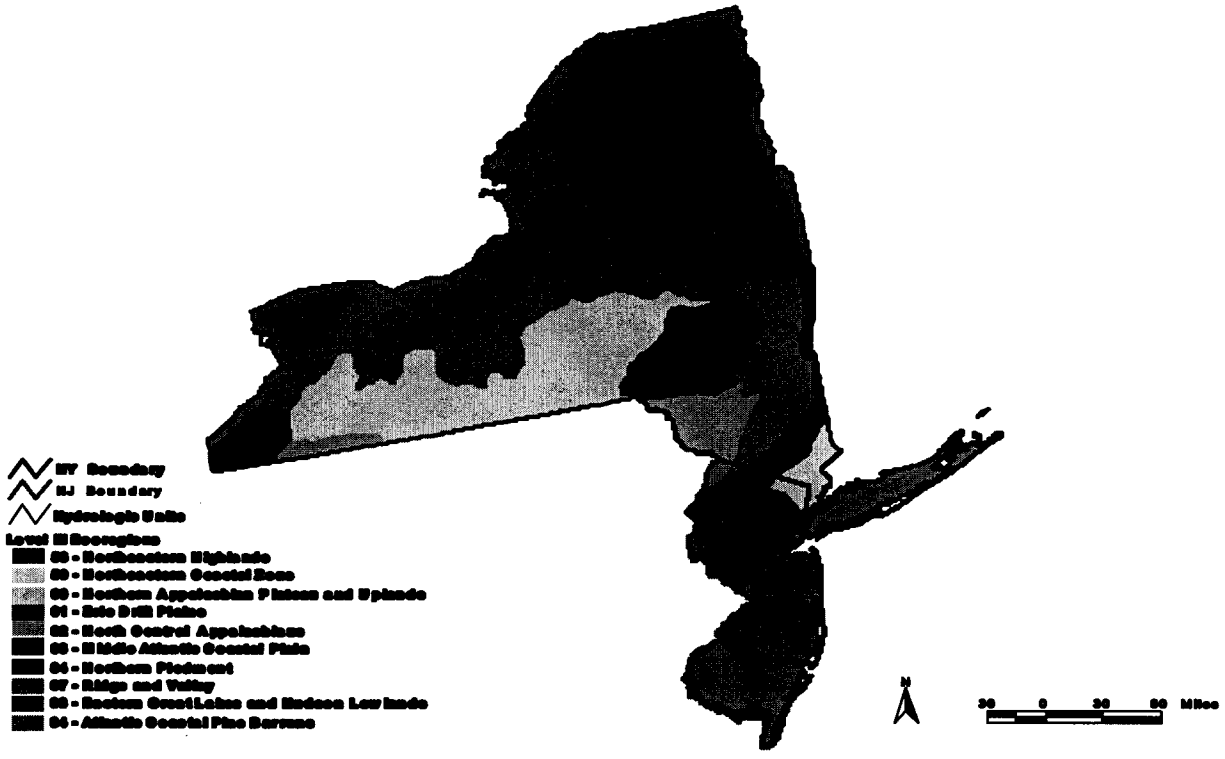
Appendix 1.

Level III Ecoregions Within New York State

Level III Ecoregion	*Description*
58	*The Northeastern Highlands comprise a relatively sparsely populated region characterized by nutrient poor soils blanketed by northern hardwood and spruce fir forests. Land-surface form in the region grades from low mountains in the southwest and central portions to open high hills in the northeast. Many of the numerous glacial lakes in this region have been acidified by sulfur depositions originating in industrialized areas upwind from the ecoregion to the west.*
59	*Northeastern Coastal Zone contains relatively nutrient poor soils and concentrations of continental glacial lakes, some of which are sensitive to acidification; however, this ecoregion contains considerably less surface irregularity and much greater concentrations of human population. Although attempts were made to farm much of the Northeastern Coastal Zone after the region was settled by Europeans, land use now mainly consists of forests and residential development.*
60	*The Northern Appalachian Plateau and Uplands comprise a transition region between the less irregular, more agricultural and urbanized Erie/Ontario Drift and Lake Plain and Eastern Great Lakes and Hudson Lowlands ecoregions to the north and west and the more mountainous and forested, less populated North Central Appalachians and Northeastern Highlands ecoregions to the south and east. Much of this region is farmed and in pasture, with hay and grain for dairy cattle being the principal crops, but large areas are in forests of oak and northern hardwoods.*
61	*Once largely covered by a maple-beech-birch forest, much of the Erie Drift Plain is now in farms, many associated with dairy operations. The Eastern Corn Belt Plains, which border the region on the west, are flatter, more fertile, and therefore more agricultural. The glaciated Erie Drift Plain is characterized by low rounded hills, scattered end moraines, kettles, and areas of wetlands, in contrast to the adjacent unglaciated ecoregions to the south and east that are more hilly and less agricultural. Areas of urban development and industrial activity occur locally.*
62	*More forest covered than most adjacent ecoregions, the North Central Appalachians ecoregion is part of a vast, elevated plateau composed of horizontally bedded sandstone, shale, siltstone, conglomerate, and coal. It is made up of plateau surfaces, high hills, and low mountains, which unlike the ecoregions to the north and west, was largely unaffected by continental glaciation. Only a portion of the Poconos section in the east has been glaciated.*

	Land use activities are generally tied to forestry and recreation, but some coal and gas extraction occurs in the west.
67	*The Ridge and Valley is a northeast-southwest trending, relatively low-lying, but diverse ecoregion sandwiched between generally higher, more rugged mountainous regions with greater forest cover. As a result of extreme folding and faulting events, the region's roughly parallel ridges and valleys have a variety of widths, heights, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are relatively numerous. Present-day forests cover about 50% of the region. The ecoregion has a diversity of aquatic habitats and species of fish.*
83	*The Eastern Great Lakes and Hudson is a glaciated region of irregular plains bordered by hills generally contains less surface irregularity and more agricultural activity and population density than the adjacent Northeastern Highlands and Northern Appalachian Plateau and Uplands ecoregions. Although orchards, vineyards, and vegetable farming are important locally, a large percentage of the agriculture is associated with dairy operations. The portion of this ecoregion that is in close proximity to the Great Lakes experiences and increased growing season, more winter cloudiness, and greater snowfall.*
84	*The Atlantic Coastal Pine Barrens is distinguished from the coastal ecoregion to the south by its coarser grained soils and Oak-pine potential natural vegetation, as compared to forests including hickory. Appalachian Oak forests and northern hardwoods were found in the coastal ecoregion to the north. The physiography of this ecoregion is not as flat as that of the Middle Atlantic Coastal Plain, but it is not as irregular as that of the Northeastern Coastal Zone.*

Adapted from Omernik, 1987.


NY Boundary
NJ Boundary
Hydrologic Units
Level III Ecoregions
58 - Northeastern Highlands
59 - Northeastern Coastal Zone
60 - Northern Appalachian Plateau and Uplands
61 - Erie Drift Plain
62 - North Central Appalachians
63 - Middle Atlantic Coastal Plain
64 - Northern Piedmont
67 - Ridge and Valley
83 - Eastern Great Lakes and Hudson Lowlands
84 - Atlantic Coastal Pine Barrens
N
30 0 30 60 Miles